

# *Duke University*

## *Math News*

*May 13, 2012*



•   ♦   •                      SPRING 2012 EDITION                      •   ♦   •

# Duke University Math News

May 13, 2012  
GRADUATION  
EDITION

## Events

### 27th ANNUAL GEOMETRY FESTIVAL

The Geometry Festival, hosted by Duke University and UNC, was held in the Math/Physics Building from Friday, April 27, to Sunday, April 29, 2012. About 75 participants from 25 universities attended this event.

The speakers this year were:

- Simon Brendle (Stanford University)
- John Etnyre (Georgia Institute of Technology)
- Fernando Coda Marques (IMPA)
- Gordana Matic (University of Georgia)
- Jan Metzger (Institute for Mathematics, University of Potsdam)
- Yanir Rubinstein (Stanford University)
- Valentino Tosatti (Columbia University)
- Mu-Tao Wang (Columbia University)

A continuing grant from the National Science Foundation makes it possible for us to partially reimburse the expenses of a large number of graduate students, post-docs and younger faculty who do not have access to travel funds from other sources. The conference was organized by Hubert Bray and others in the Duke and UNC mathematics departments.

### Women in Probability

The third Workshop for Women in Probability will be held at Duke October 14-16, 2012. This is the third conference of this series. The previous two

were held at Cornell University, the first in 1994 and the second in 2008.

The program was organized by Tai Melcher (Virginia) and Amber Puha (San Marcos) with Rick Durrett and Jonathan Mattingly taking care of the local arrangements.

The workshop will feature one hour talks by Janet Best (Ohio State), Alexandra Chronopoulou (UCSB), Cindy Greenwood (Arizona State), Alice Guionnet (ENS Lyon), Kay Kirkpatrick (UIUC), Nevena Marić (Missouri), Dana Randall (Georgia Tech), Amandine Véber (CMAP), Amy Ward (USC), and Jessica Zuniga (Duke). For more information visit the conference web page at <http://www.math.duke.edu/~rtd/wwp12/>. ShiShi Luo, Sarah Schott, and Rachel Thomas, graduate students at the time, attended the 2008 conference at Cornell. See <http://www.math.duke.edu/~rtd/wwp/photo08.html>

Alice Guionnet will present a Gergen Lecture on this visit. After many years at ENS in Lyon, Alice will be moving to a faculty position at MIT in the Fall. Among Alice's many honors are the Rollo Davidson prize in 2003, Loeve prize in 2009, and a lecture at the ICM in 2006. Her thesis written under the direction of Gerard Ben Arous concerned the Sherrington-Kirkpatrick model of spin glasses. Much of her recent work concerns random matrices. See her book with G. Anderson and O. Zeitouni.

### Gergen Lecture

On February 28, Jordan Ellenberg gave the 2011-12 Gergen Lecture on *Stability and Arithmetic Counting Problems*.

Abstract:

A big theme in contemporary number theory is "arithmetic statistics": what does the class group of a random number field look like? What do the zeroes of a random L-function look like? What does a random rational point on a variety look

like? In this talk we will explain how arithmetic statistics problems over function fields are naturally tied to topological questions about stability for homology groups of certain moduli spaces; in particular, we will explain how a stability theorem for Hurwitz spaces (moduli spaces of finite branched covers of the line) can be used to prove a version of the Cohen-Lenstra conjectures over function fields.

### First Math Slam @ Duke

A Poetry Slam is when poets meet in a bar and present their poetry to lovers of poetry. And a Math Slam is when mathematicians meet in an overcrowded seminar room full of lovers of mathematics of all ages, career stages, and math specialties to present... their math! Every speaker gets 10 minutes, a blackboard, a projector, and an audience eager to learn and be entertained at the same time. Do you think you could do this?

The speakers of Duke's first Math Slam – Elizabeth Munch, Christopher Cornwell, David Herzog, Alan Parry, and Dave Rose - showed that social behavior of apes resembles vineyards, described painless surgery with topologically non-removable fibers, explained why we should love probability, told us why dark matter matters, and untied other knotty problems.

Much thanks goes to Carla Cederbaum who organized this first Duke math slam.

## Undergraduate News

### DUMU

The Duke University Math Union has sponsored several notable events this year such as the Duke Math Meet, the alumni undergraduate lecture, and several social events. Many thanks to graduating president, Vivek Bhattacharya and the other graduating officer. We welcome TongTong Zhan as president for the upcoming year.

### Student-Faculty Math Party

The math undergrad/faculty party was held Thursday afternoon from 3 until 4:30 on April 26

in Math Physics 101. This is the department's annual opportunity for students and faculty to meet and chat in an informal setting over sandwiches and soda.

At this event, students were recognized for their awards and contributions to the mathematical life of the department. All in the Duke math community and especially those who are graduating are encouraged to attend.

### Melanie and Phil Matchett Wood

On Thursday December 1, 2011, DUMU featured Melanie Matchett Wood '03 with the undergraduate alumni lecture *The Chemistry of Primes*.

We are familiar with the prime numbers as those integers which cannot be factored into smaller integers, but if we consider systems of numbers larger than the integers, the primes may indeed factor in those larger systems. We discuss various questions mathematicians ask about how primes may factor in larger systems, talk about both classical results and current research on the topic, and give a sense of the kind of tools needed to tackle these questions.

Melanie was a two time medalist at the International Mathematical Olympiad, a Putnam Fellow, Morgan Prize winner, and American Institute of Math Fellow along with many other honors. Her Duke Math shirt has been retired and hangs in the math lounge.

Melanie and her husband Philip are each Assistant Professors of Mathematics at the University of Wisconsin, Madison. In addition to the undergraduate lecture, each gave a more technical seminar on their recent research results. They brought their 18 month daughter, Abelia with them. After the Undergraduate Lecture, a half dozen DUMU members took Melanie, Philip and Abelia to Parizade for an entertaining conversation.

### Duke Math Meet

Nearly 400 high school students from New Jersey to Georgia participated in the annual Duke Math Meet on Saturday, November 12. About 40 Duke

students helped to make up and grade the problems, purchase and distribute the awards, serve box lunches, and a myriad of other tasks.

Senior Seung In Sohn from Thomas Jefferson was the highest scorer in the contest followed by Allen Yang of Cary Academy, Calvin Deng of NCSSM, David Stoner and Elliott Chartock of the Columbia Math Circle, and Brendan Fletcher of the Charlotte Math Club.

The team from Columbia Math Circle took first prize followed by a team from NCSSM, two teams from AAST and a team from Thomas Jefferson SST.

### ACM Programming

The ACM International Collegiate Programming Competition (ACM-ICPC) is an annual programming competition involving several thousand teams from universities all over the world. This year, a team from Duke University placed first out of over 160 teams in the Mid-Atlantic Regionals of the ACM-ICPC, thereby qualifying for the World Finals. The team of three, Joe Keefer (Math/Econ '12) and two graduate students from the Computer Science Department along with Assistant Coach, Siyang Chen (Math/CS '12), will travel to Warsaw, Poland, this May for the finals to compete against about 100 other teams. Duke University has qualified for the World Finals every year except one since 1994.

### Datafest

The inaugural DataFest was held this April. In this competition, teams of undergraduates work for 48 hours to analyze a large and complex dataset. This year's theme was micro lending. Participants analyzed six years of data from Kiva.com on lenders, borrowers, loans and their field partners with the goal of making recommendations to a Kiva user or discovering insights into Kiva or micro lending in general.

The team of Dazhong (Chime) Xuan, Christine Cheng, Tianxiang Xiong, Tori Reynolds, and Dylan Britt won the prize for best visualization. See <http://stat.duke.edu/datafest>.

### Putnam Competition

The team of Vivek Bhattacharya, Leslie Lei and Daniel Vitek finished 16th among 572 colleges and

universities in the 62st W.L Putnam Competition. Daniel finished near the top of the Honorable Mentions and Vivek and Michael Banaszek were among the top 4% of the 4440 participants. Ben Bellis, Andrew Hertzberg, and Leslie Lei ranked among the top 500 and David Hemminger, Joe Keefer, Kathleen Lan, and Eugene Rabinovich were among the top 20% of the 4440 participants.

Harvard won the contest this year followed by Carnegie Mellon, Cal Tech, Stanford and MIT. The median score was 0 and only 25% of participants scored 3 or more points.

### MCM

Three Duke teams were among nearly 3,700 teams of undergraduates from around the world to participate in the 2012 International Mathematics Contest in Modeling. Freshman Leslie Lei and Juniors Tianxiang Xiong and Dazhong (Chime) Xuan garnered a Meritorious (top 10%) ranking while the teams of sophomores Aashiq Dheeraj, Xiaoyu (Mandy) Jiang and Kathleen Lan and the team of freshmen David Hemminger, Logan Su, and Christy Vaughn received Honorable Mention for their solutions.

Each Duke team derived a method to schedule 6 to 18 day trips along the Big Long River so as to maximize the wilderness experience and minimize the overlap with other groups. The teams used various combinatorial methods such as the asymmetric travelling salesman problem and genetic algorithms to arrive at an efficient means for scheduling the trips during the busy summer months.

### Menger Prize

The Menger Prize, named for renowned Austrian mathematician Karl Menger, is awarded to the students with the best score on the W.L. Putnam Mathematical Competition. The winners this year are Daniel Vitek '14, Michael Banaszek '13, and Vivek Bhattacharya '12.

### Julia Dale Prize

The winners of the 2012 Julia Dale Prize for excellence in mathematics are Vivek Bhattacharya, and Veronica Ciocanel. This is the highest honor offered by the mathematics department.

Veronica, a Mathematics and French major who comes to us from Romania, was Finalist both for

the Mathematics Contest in Modeling and for the Faculty Scholarship. She has written two major research papers soon to be published and has been awarded graduation with distinction for her paper with Tom Witelski on the non-linear dynamics of a pendulum on a string. Veronica also completed a major research project with Mike Reed on the genetic conflict involved in gestational diabetes. Veronica will attend Brown University to continue her study of applied mathematics.

Vivek is an Economics and Physics major who has more than fulfilled the requirements for a major in Mathematics. He has been coordinator of the Duke Math Meet, twice a Finalist on the Mathematics Contest in Modeling, a two time winner of the Menger prize, a Faculty Scholar, and is currently president of DUMU. Vivek will continue his study of Economics at MIT.

The freshman Julia Dale prize is awarded to the first year students who have most distinguished themselves in mathematics. The winners this year are David Hemminger, Leslie Lei Lei and Eugene Rabinovich. Each has excelled in advanced undergraduate courses this year.

### PRUV

Ben Bellis, Adrian Chan, Kyu Won Choi, Veronica Ciocanel, Kaveh Danesh, Theo Frehlinghuysen, Yingyi Shen, and Danny Thielman have written senior theses this year and will give talks on their research to the Duke math community. Most of these students received stipends through the PRUV Fellow program. New PRUV Fellows are Bryan Jacobson, Mandy Jiang, Kathleen Lan, Ivy Shen, Daniel Stern, and Daniel Vitek.

### Graduation with Distinction in Mathematics

Six math majors will graduate with distinction this May.

- Ben Bellis - *Investigation of a local computation of the signature from the triangulation of a manifold*
- Adrian Chan - *Pricing financial derivatives with multi-task machine learning and mixed effects methods*

- Kyu Won Choi - *Relative contributions of common jumps in realized correlations*
- Veronica Ciocanel - *Analysis of the nonlinear dynamics of the forced planar string pendulum*
- Kaveh Danesh - *A branching process model for ovarian cancer*
- Theo Frehlinghuysen - *Carbon sequestration via forest management techniques*

### Duke Faculty Scholarship

Vivek Bhattacharya was one of two Faculty Scholars this year. Although an Economics and Physics major, Vivek has taken more than enough courses to qualify as a math major were triple majors allowed in Trinity College. Mathematics and French Studies major Veronica Ciocanel was one of two students named Honorable Mention in this the highest award that the Duke faculty can bestow on its undergraduates.

### New Course

Ingrid Daubechies, Jonathan Mattingly, and Ezra Miller are team-teaching a new course this year, Math 81: "Math Everywhere".

### Math Mentoring

Initiated by Christine Berkesch, Carla Cederbaum, Benjamin Cooke, and Sarah Schott, the Department of Mathematics and the Academic Resource Center will together offer a mentoring program for female first-year students interested in math. Starting in the coming Fall, this program pairs female first-years who declared an interest in mathematics with upperclass women pursuing a major or minor in math. The goal of the program is to increase identification and retention among our female students. We are still looking for more mentors!

To sign up for the program as mentor or mentee, please visit <http://www.math.duke.edu/mentors/>, or if you have any questions, you can contact the organizers via [mentoring@math.duke.edu](mailto:mentoring@math.duke.edu).

## Graduate Student News

### Graduating Ph.D. Students in 2011-12

Congratulations to our graduate students who defended their doctoral theses this year. Each has accepted an academic position for the upcoming year. They, their advisors and their positions are:

**Prakash Balachandran** has accepted a postdoc position at Boston University  
Advisor: Jonathan Mattingly

**Graham Cox** is a Lorenz postdoc at the University of North Carolina, Chapel Hill.  
Advisor: Hugh Bray

**Esteban Chavez** has accepted a postdoc position at UC Santa Barbara.  
Advisor: James Nolen

**Kevin Gonzales** is Assistant Professor at Shaw University  
Advisor: David Schaeffer

**Tiffany Kolba** will be an Assistant Professor at Valparaiso University  
Advisor: Jonathan Mattingly

**Michael Pruitt** has a postdoc position at the University of Connecticut  
Advisor: J Thomas Beale

**David Rose** will be Busemann Assistant Professor at the University of Southern California  
Advisor: Lenny Ng

**Sarah Schott** will be Assistant Professor of the Practice at Duke University  
Advisor: Mark Huber

Shishi Luo received the Katherine Goodman Stern Fellowship for the period of September 1, 2012 to May 31, 2013. This fellowship, awarded by the Graduate school, covers a year's stipend for final year PhD students.

Elizabeth Munch won the first Jo Rae Wright Fellowship for Outstanding Women in Science. See <http://today.duke.edu/2011/12/wright/-fellowships>

## Faculty News

James B. Duke Professor of Mathematics Ingrid Daubechies received the Okawa Prize for her outstanding and pioneering contributions to the theory and applications of wavelets. See more at <http://www.okawa-foundation.or.jp/en/activities/prize/list.html>

She has also been awarded the 2012 Nemmers prize for academic excellence in mathematics. This award carries a \$150,000 stipend and the scholar spends 10 weeks in residence at Northwestern University. See [http://en.wikipedia.org/wiki/Nemmers\\_Prize\\_in\\_Mathematics](http://en.wikipedia.org/wiki/Nemmers_Prize_in_Mathematics).

## Retirements

### Jack Bookman

After 30 years at Duke, Jack Bookman will retire this spring as Professor of the Practice of Mathematics. In addition to teaching many first and second year mathematics courses, Jack has coordinated the training of graduate student instructors and developed methods to evaluate many of the reform calculus programs around the country. He has advised undergraduates interested in teaching at secondary schools and taught education courses for them. Jack has published 22 articles on mathematical education and given numerous talks at national conferences. He plans to continue to write and speak about calculus teaching reform and teacher and student assessment.

### David Schaeffer

In June, Dave Schaeffer will retire from the Mathematics Department. He grew up in Cincinnati, was an undergraduate at the University of Illinois, and received his Ph.D. from MIT in 1968, under the supervision of Takeshi Kotake.

After ten years at Brandeis and back at MIT, he came to Duke in 1978, and he was appointed James B. Duke Professor of Mathematics in 1990. "It has

been very gratifying to participate in the dramatic improvement of this department over that period," he reflects.

Throughout his career Schaeffer studied problems of various kinds involving differential equations, both ordinary and partial. Starting from a fairly "pure" focus, he moved consistently towards more applied problems over the years.

His most widely cited research was in bifurcation theory, culminating in the two-volume monograph *Singularities and Groups in Bifurcation Theory*, with Marty Golubitsky and Ian Stewart. Later work introduced the subject of granular flow to the mathematics and physics communities, and this area has grown to a major subfield. More recently he has been interested in mathematical biology, especially problems in cardiac dynamics.

Schaeffer directed 14 Ph.D. theses while at Duke, and he supervised several postdoctoral associates, in Math and other departments. But perhaps his best known educational contribution, at least locally, was his innovative case-study course in mathematical modeling. In this course he introduced math graduate students to mathematical issues in the research area of a professor in another department at Duke, and he guided them towards performing independent research in this area by the end of the term. He taught the course about a half dozen times, each semester with a different focus. Several Ph.D. theses in diverse areas grew out of this course, and in fact Schaeffer's own late-career work in electrocardiology arose through it.<sup>1</sup>

In collaboration with his former student John Cain (now at the University of Richmond), Schaeffer is writing an introductory graduate ODE textbook. This book, which will be freely available on the internet, is based on the course he taught for over a decade, all the while dissatisfied with the available texts. In fact, even in retirement, he will teach this course a few more times in order to get student feedback on the manuscript.

While not ready to give up research, he is also looking forward to pursuing neglected interests like sailing, piano, and non-mathematical reading; he welcomes the chance to get enough exercise; he is relishing the prospects of travel unhampered by the

<sup>1</sup>This course was written up in the Notices of the AMS **43** (1996), p550 and in SIAM Review **40** (1998), p356.

academic calendar; he is exploring opportunities for volunteer work, including tutoring ("I know I am going to miss working with students," he laments); he plans to take up something wholly new like learning to draw or becoming fluent in Spanish.

"How am I going to find time to do all that stuff?" he muses.

### John Trangenstein

After 21 years at Duke, John Trangenstein has freed himself from administrative and teaching responsibilities. He plans to devote more time to writing an interactive book on Scientific Computing, studying Chinese with thoughts of giving lectures at Jiao Tong University in Shanghai and especially to enjoy sailing. He is happy to be able to sail whenever the weather is good, not just when his schedule is open.

Trangenstein wrote his PhD in 1975 with Jim Bramble at Cornell and then taught at UCSD for 4 years. After a series of research positions at a small defense consulting firm, Exxon Production Research, and Lawrence Livermore National Laboratory, he accepted a faculty position at Duke

While at Duke, Trangenstein supervised 4 PhD students and published 2 books with Cambridge University Press (*Numerical Solution of Hyperbolic Partial Differential Equations* in 2009, and *Numerical Solution of Elliptic and Parabolic Partial Differential Equations* in 2012).



## Math Degree Candidates, Academic Year 2011–12

### First Majors

Mr. Ben Bellis  
 Ms. Callie Merriam Berkowitz  
 Mr. Scott David Brothers  
 Mr. Dae Hyun Byun  
 Mr. Nathan Thomas Carlin  
 Mr. Alexander Jaekwon Cha  
 Mr. Adrian Chan  
 Mr. Siyang Chen  
 Mr. Yunze Chen  
 Ms. Kyu Won Choi  
 Ms. Veronica Maria Ciocanel  
 Mr. Kaveh Danesh  
 Mr. Sean P. Dillard  
 Mr. Tyler Xavier Donahue  
 Mr. Theodore John Frelinghuysen  
 Mr. Timothy Parkman French  
 Mr. Michael Bradley Goodrich  
 Mr. Michael Seth Jaffe  
 Mr. Joseph John Keefer  
 Mr. Daniel Martin Kindya  
 Ms. Anna Y. Kuznetsova  
 Mr. Boris Tsz Hin Lau  
 Mr. Donovan Wen Min Lee  
 Ms. Lingfeng Li  
 Mr. You Li  
 Ms. Leslie Irene Morrison  
 Mr. Keunyoung Oh  
 Mr. Michael Diego Osorio  
 Mr. Ethan Haddox Pollard  
 Mr. David Benjamin Reynolds  
 Mr. Scott Benjamin Rich  
 Mr. Michael Schuyler Rock  
 Ms. Yingyi Shen  
 Mr. Matthew Ryan Straus  
 Ms. Ana-Maria Kirilova Tenekedjieva  
 Mr. Daniel Wilson Thielman  
 Mr. Shengyan Wang

### Second Majors

Mr. Nicholas Woody Bodnar

Mr. Travis Wade Byington  
 Mr. Alejandro Javier Cortese  
 Ms. Natalie Ann Dorrow  
 Mr. Yong-Hui Goh  
 Mr. Nathan Christopher Klug  
 Mr. Mingwei Lei  
 Mr. Dea Yong Park  
 Mr. Gaurav Nath Sabharwal  
 Mr. Hao Sun  
 Mr. Ross Jackson Sylvester  
 Mr. Trevor Kennedy Terris  
 Mr. Peichun Wang  
 Mr. Yu-Po Wong  
 Mr. Fengqi Xu

### Minors

Mr. Daniel Patrick Ahrens  
 Mr. Peter Bartlett Bastian  
 Mr. Adam Bennett  
 Mr. Samuel Isaac Berchuck  
 Mr. Vivek Bhattacharya  
 Mr. Sami Boghos  
 Mr. Ronald Cass  
 Mr. Meng-Yang Chen  
 Mr. Austin Ross Ely  
 Mr. Julian Zachary Genkins  
 Ms. Sarah Holle Gustafson  
 Mr. Robert Davis Helms  
 Mr. Jacob Rueywen Hwang  
 Ms. Alyson Elaine Johnson  
 Mr. Jordan Kassof  
 Mr. Alexander Jacob Kritchevsky  
 Mr. John Liu  
 Mr. Yong Chuan Roger Look  
 Mr. Ryan Michael Magee  
 Mr. Amaan Amjad Mitha  
 Ms. Nicole Rose Page  
 Mr. Jeffrey Peyser  
 Mr. Sameer Prasada  
 Mr. Vijay Ram  
 Mr. Tyler Rohr  
 Mr. Shreyan Sen  
 Ms. Lauren Shwisberg  
 Ms. Allison Lara Stashko  
 Mr. Jack H. Stringfield  
 Mr. Bruce Sun  
 Ms. Shuting Wei



Ms. Meng Xie  
 Mr. Edward Yi  
 Ms. Hazal Yuksel  
 Mr. Samuel Hoy Zimmerman, III

### Master of Arts

Ms. Caitlin J. Levenson  
 Mr. Alexander D. Pruss  
 Mr. Joseph John Schmitt

### Ph.D.

Dr. Esteban Alejandro Chavez  
 Dr. Tiffany Nicole Kolba  
 Dr. David Emile Rose  
 Dr. Sarah Jane Schott

## Duke Math News

The *Duke Math News* is published several times a year and is distributed to those in the Duke mathematics community. For previous editions and other news, see <http://www.math.duke.edu/news/>. We welcome items of interest for our next issue. Send them to [dept@math.duke.edu](mailto:dept@math.duke.edu) or [dkrain@duke.edu](mailto:dkrain@duke.edu)

To read about other news, honors and events concerning mathematics at Duke, visit <http://www.math.duke.edu/news/>. The on-line calendar at <http://www.math.duke.edu/mcal> lists both regular and special seminars and colloquia for the upcoming weeks. The department maintains video archives of talks, lecture series and special conferences at Duke, many of which are available, on-line. See <http://www.math.duke.edu/computing/broadcast.html> for more information.

—David Kraines, DMN Faculty Sponsor

#### FACULTY SPONSOR

*David Kraines* ..... [dkrain@math.duke.edu](mailto:dkrain@math.duke.edu)

#### PRODUCTION MANAGER

*Bonnie E. Farrell* ..... [bef@math.duke.edu](mailto:bef@math.duke.edu)

Department of Mathematics

Box 90320

Durham, NC 27708-0320

[http://www.math.duke.edu/math\\_news/](http://www.math.duke.edu/math_news/)